

# Columbia/Snake River Temperature TMDL

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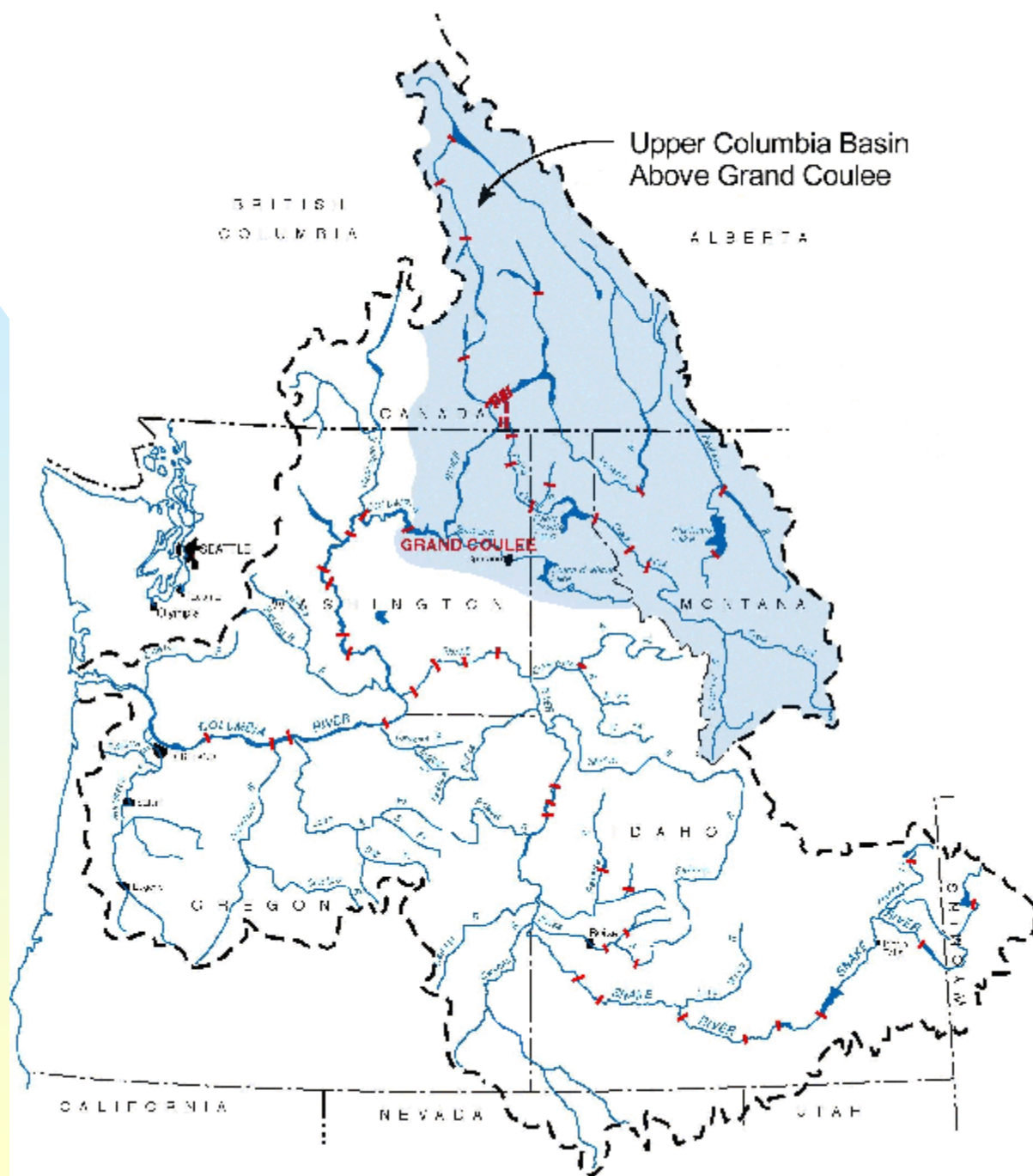
Washington Department of Ecology

April 1, 2002

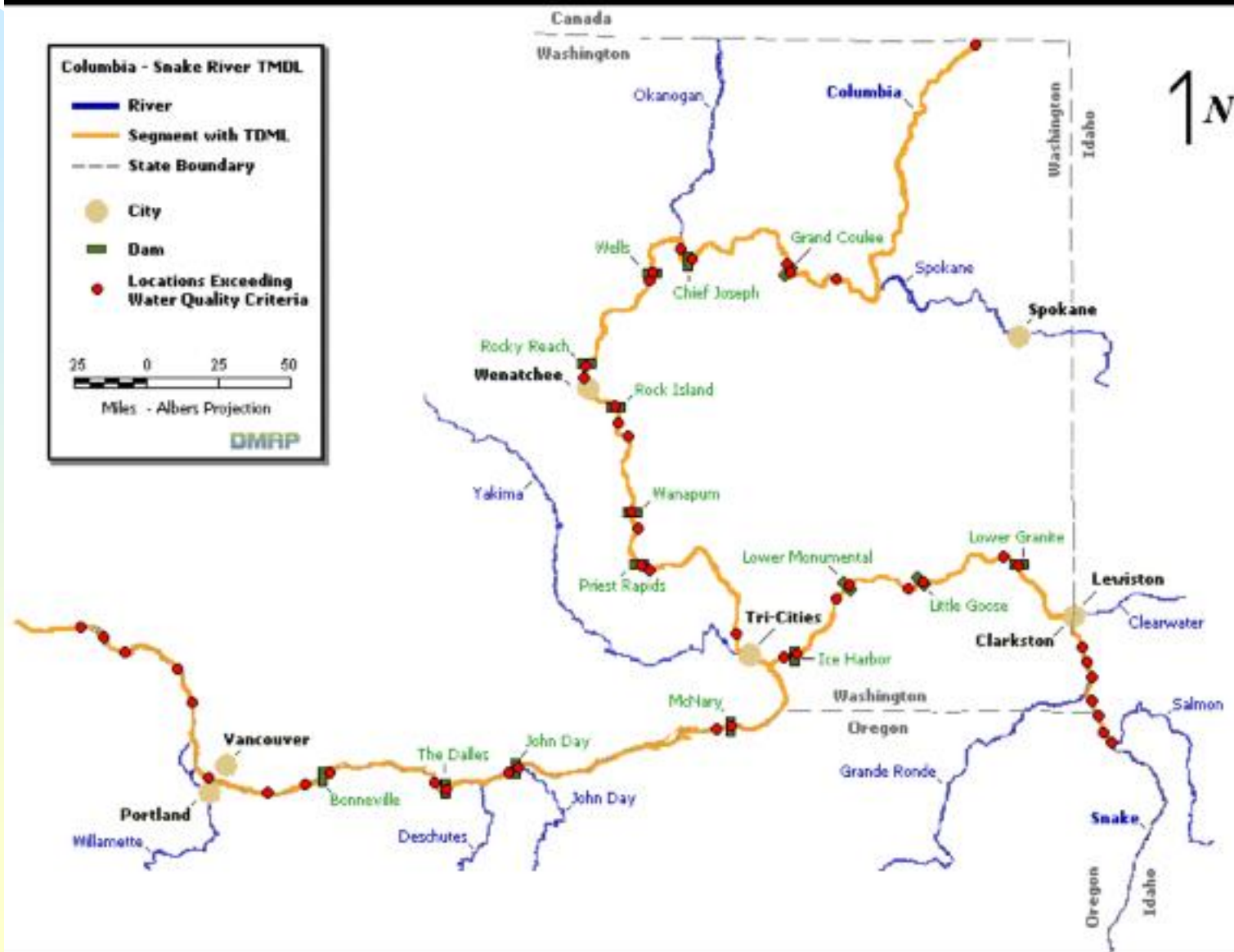


# Purpose




- Review the Columbia/Snake Mainstem Temperature TMDL
- Identify and Discuss Potential Policy Issues



# Geographic Scope



# TMDL Development

- Model Development 
- Problem Assessment 
- TMDL 

# Model Development

- **Developed for the Columbia/Snake river system**
- **Peer Reviewed**
- **Regional Review - industry, contractors, federal agencies.**
- **Numerous public meetings, two public workshops**
- **One Dimensional Energy Budget Mathematical Model.**
- **Cross sectional averaged temperature**
- **Daily or hourly average temperature**



# Problem Assessment

Does water temperature in the  
Columbia and Snake Rivers  
exceed Water Quality Standards?

# Problem Assessment

1) Does temperature exceed the Water Quality Criteria?

**Yes**

2) Does temperature exceed the Water Quality Criteria due to human activities?

**Yes**



# Problem Assessment

- A significant cause for the altered temperature regime in the rivers is the presence of the dams.
- Climate change likely contributes to the trend to a lesser extent.
- Non-point and point sources contribute to a small extent.

# TMDL Development

- 1) Determine Target Temperatures**
- 2) Establish Loading Capacity**
- 3) Allocate Available Load**

# Water Quality Standards

The WQS for this TMDL are the natural temperatures of the Columbia and Snake main stems plus small incremental increases due to human activity.

# Water Quality Standards

Natural stream temperatures for this TMDL are those that would occur in the main stems within the TMDL study area in the absence of human activity within the main stems in the study area.

**They are termed site potential temperatures in this TMDL.**

# Target Temperature Development

1. Modeled the Site Potential River\_for 30 years.
2. Computed the 30 year mean site potential at each dam tailrace. The dam tailrace stations are the target sites for the TMDL.
3. The target temperatures equal the mean site potential at each Target Site plus increments allowed by WQS.
4. The WQS increments are a mix of Colville, Oregon and Washington WQS.
5. Compliance with the target temperatures in the upstream reaches above McNary results in exceedance of WQS in the OR/WA Border reach.



# Target Temperature Development

6. We need to restrict the target temperatures upstream of McNary in order to meet the targets downstream McNary.
7. If all the reaches get the same increase above site potential, that increase would be 0.02 C when Site Potential is more than criteria and 0.15 C when site potential is less than criteria.
8. The existing point sources cause increases greater than 0.02 C and 0.15 C but not greater than the downstream allowed increments of 0.14 C and 1.1 C.

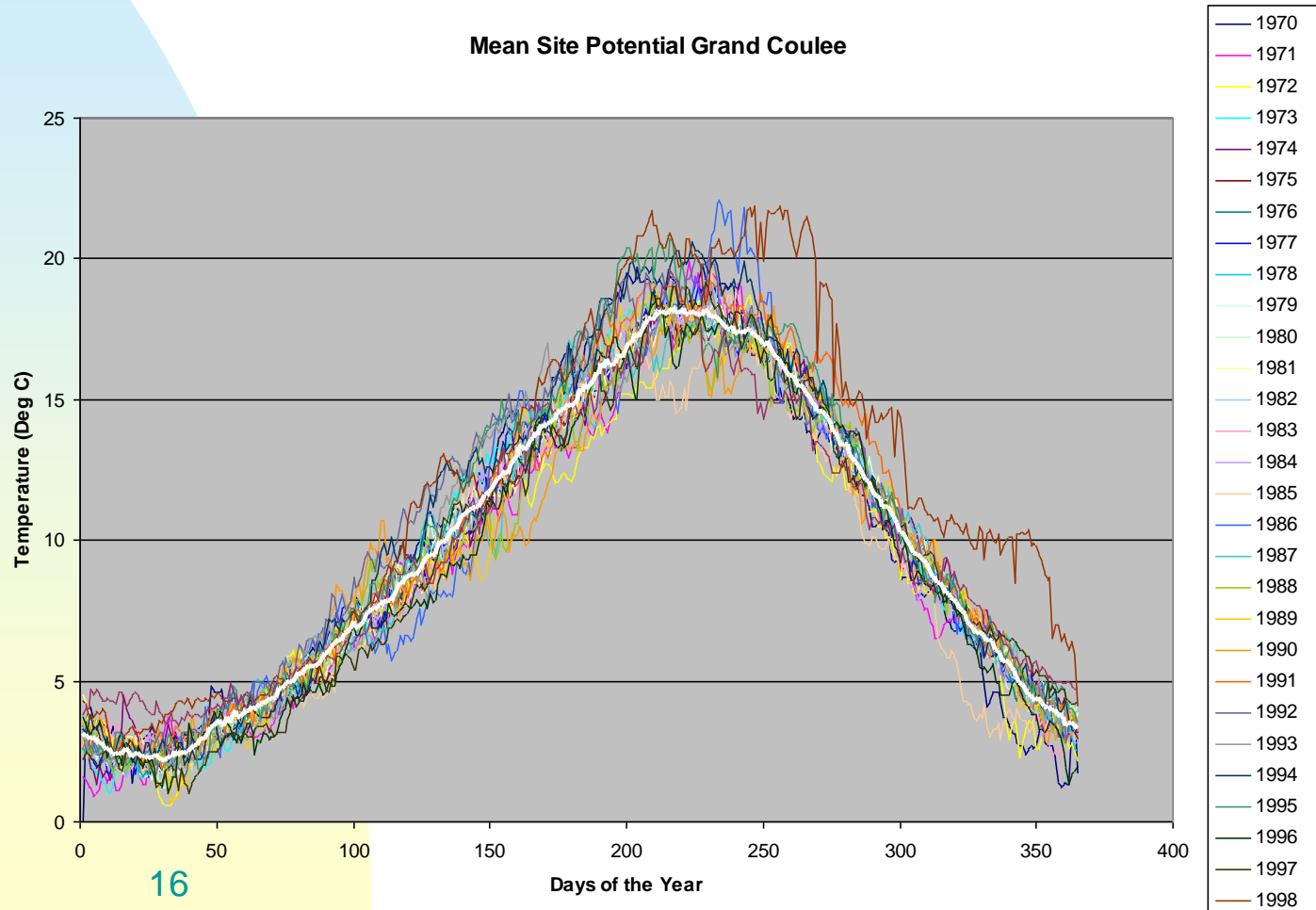
# TMDL Development

- 9. Loading at the Target Sites is expressed as Temperature instead of thermal load.
- 10. Loading Capacity at the Target Sites is the Target Temperature
- 11. Load available for allocation at the Target Sites is the WQS increment.

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# Columbia River Target Temperatures

<u>River Reach</u>	<u>Criterion</u>	<u>SP&lt;Criterion</u>	<u>SP&gt;Criterion</u>
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## **Canadian Border to Grand Coulee**

16 C	$SP + 23/(T+5)$	$SP + 0.3\text{ C}$
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## **Grand Coulee to Chief Joseph**

16 C	$SP + 23/(T+5)$	$SP + 0.3\text{ C}$
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## **Chief Joseph to Priest Rapids**

18 C	$SP + 28/(T+7)$	$SP + 0.3\text{ C}$
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## **Priest Rapids to OR/WA Border**

20 C	$SP + 34/(T+9)$	$SP + 0.3\text{ C}$
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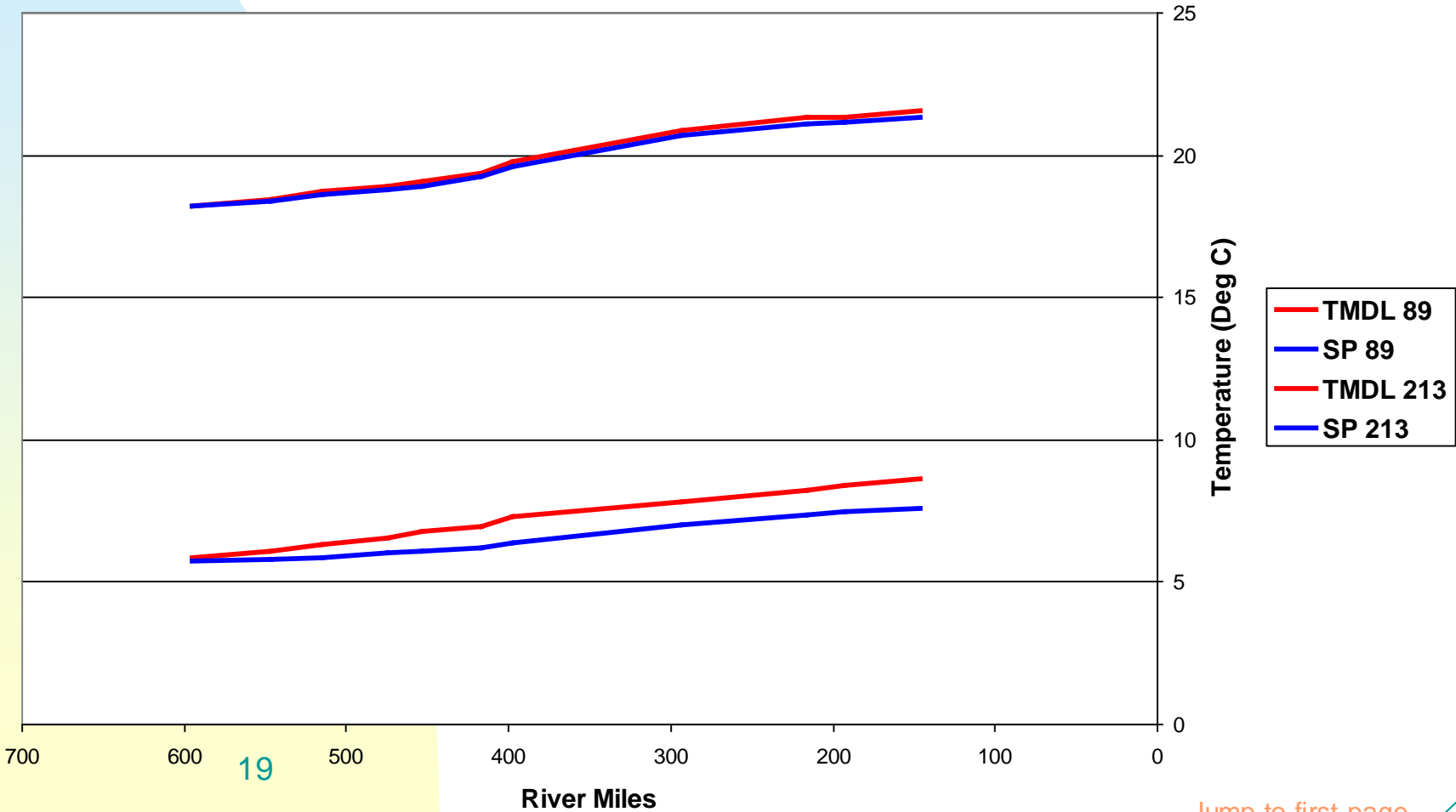
## **OR/WA Border to the Mouth**

20 C	$SP + 1.1\text{ C}$	$SP + 0.14\text{ C}$
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6. We need to restrict the target temperatures upstream of McNary in order to meet the targets downstream of McNary.

Target and Site Potential Temperatures Along the Columbia -  
March 30 and August 1



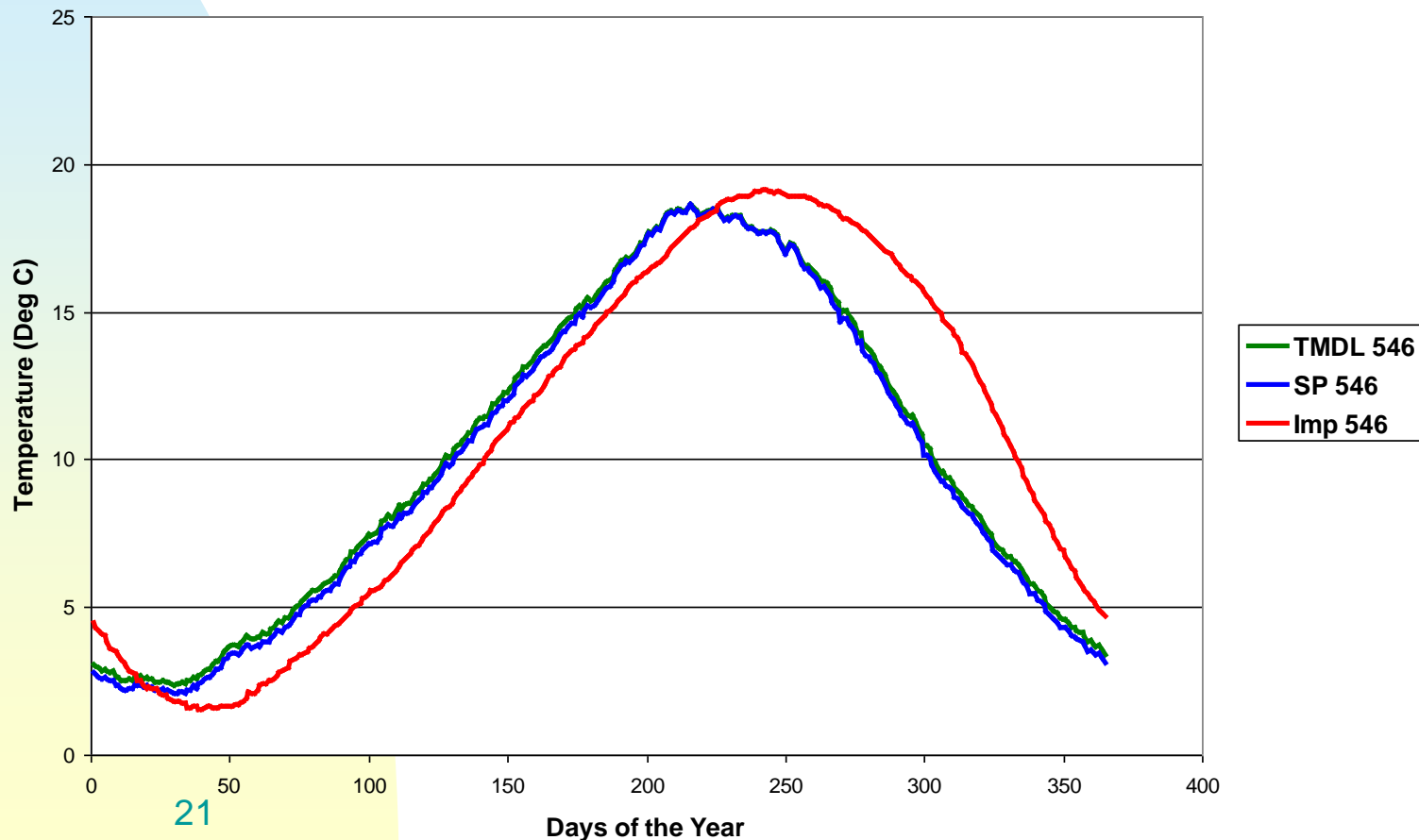
## 6. We need to restrict the Target Temperature upstream of McNary in order to achieve the targets downstream

There are many ways to allocate the target temperature:

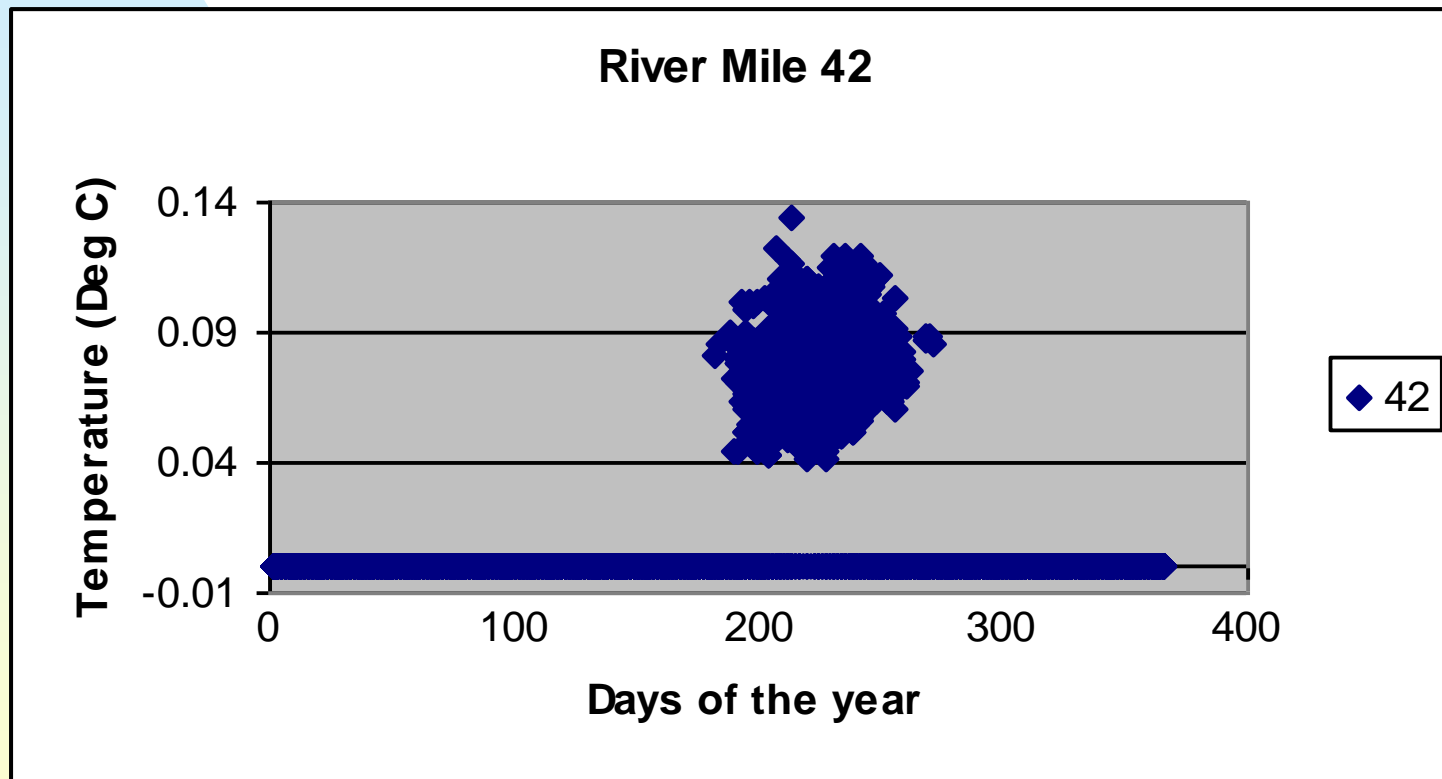
1. Give all the target reaches the same incremental increase above SP so that the downstream WQS are achieved.
2. Base the incremental increase for a reach on impacts to temperature in the reach.
3. Base the incremental increase for a reach on the length of the reach.
4. Ensure each reach has sufficient increase above site potential to cover the point sources, then allocate the remainder to the dams.

7. If all the reaches get the same increase above site potential, that increase would be 0.02 C when Site Potential is more than criteria and 0.15 C when site potential is less than criteria (Approach 1).

**Chief Joseph Target, Site Potential and Impounded Temperatures**



8. The existing point sources cause increases greater than 0.02 C and 0.15 C but not greater than the downstream allowed increments of 0.14 C and 1.1 C.



Approach 2 exacerbates this problem because it reduces the increase downstream. Approach 3 may ease the problem a bit (but not enough) downstream of Bonneville.

### Approach 2:

Base the incremental increase for a reach on impacts to temperature in the reach.

### Approach 3:

Base the incremental increase for a reach on the length of the reach.

Approach 4 would ensure that the Point Sources are covered by existing permits but would decrease the incremental increases in temperature allowed at that dams.

#### Approach 4:

Ensure each reach has sufficient increase above site potential to cover the point sources, then allocate the remainder to the dams.



## 9. Loading at the Target Sites is expressed as Temperature instead of Thermal load.

- Loading Capacity in this TMDL is in terms of Temperature rather than thermal load.
- Temperature is being used as “another appropriate measure” as per the regulations.
- Thermal load is not used because the dams are the most significant causes of temperature change but they do not discharge a thermal load to the river and they can alter load without affecting temperature.



## 10. Loading Capacity at the Target Sites is the Target Temperature.

For this TMDL the Loading Capacity is the Target Temperature.

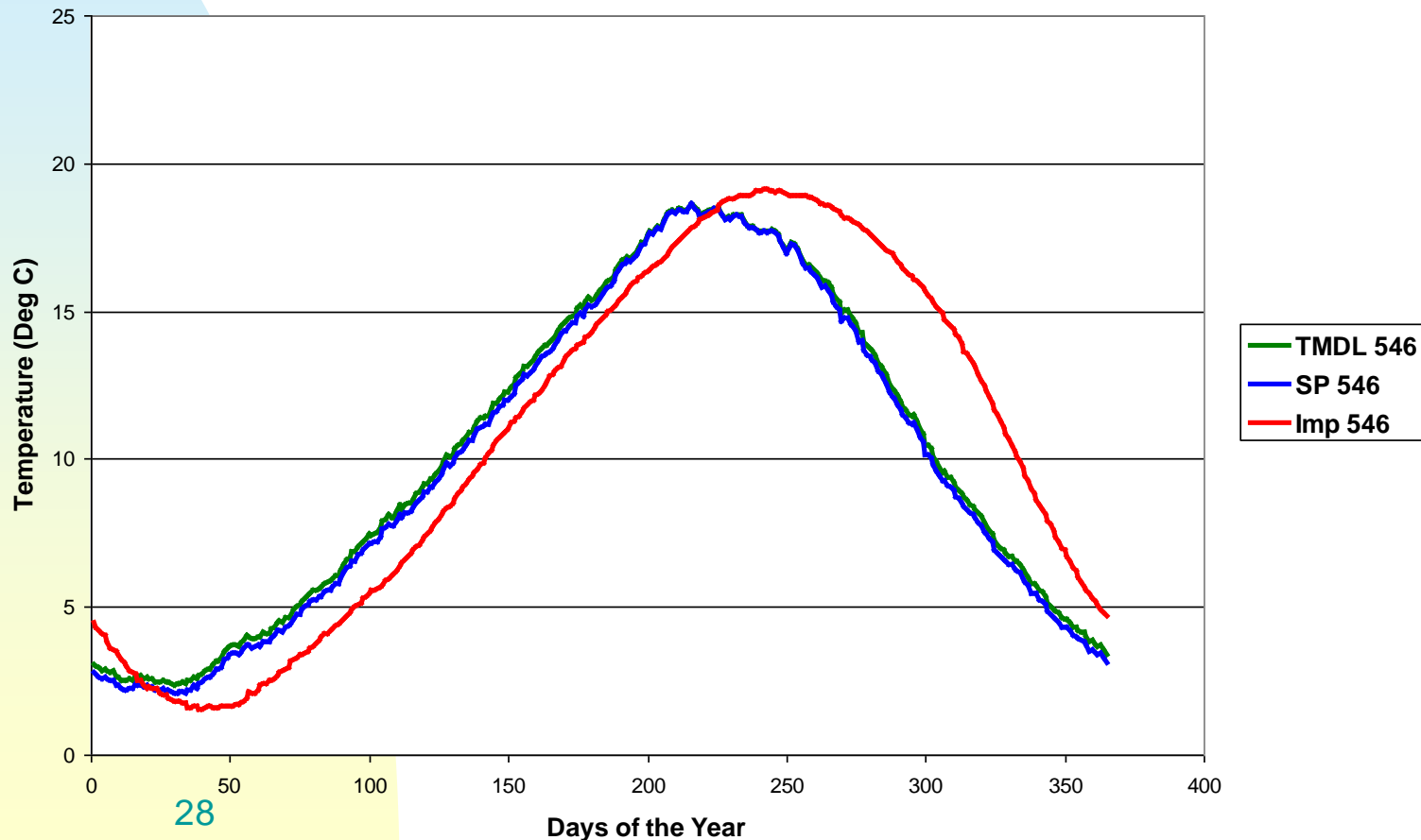
## 11. Load available for allocation at the Target Sites is the WQS Increment

The load available for allocation to dams, point sources, non-point sources, and future growth is the incremental increase allowed at each target site to achieve the target temperature:

- 0.02 C when the SP > criteria (Approach 1)
- 0.15 C when the SP < criteria (Approach 1)

7. If all the reaches get the same increase above site potential, that increase would be 0.02 C when Site Potential is more than criteria and 0.15 C when site potential is less than criteria (Approach 1).

**Chief Joseph Target, Site Potential and Impounded Temperatures**



# Measuring Compliance

Long Term System Level Compliance:

- Compliance with the target temperatures. That is, mean water temperature at the target sites equals the target temperatures.

# Important Points

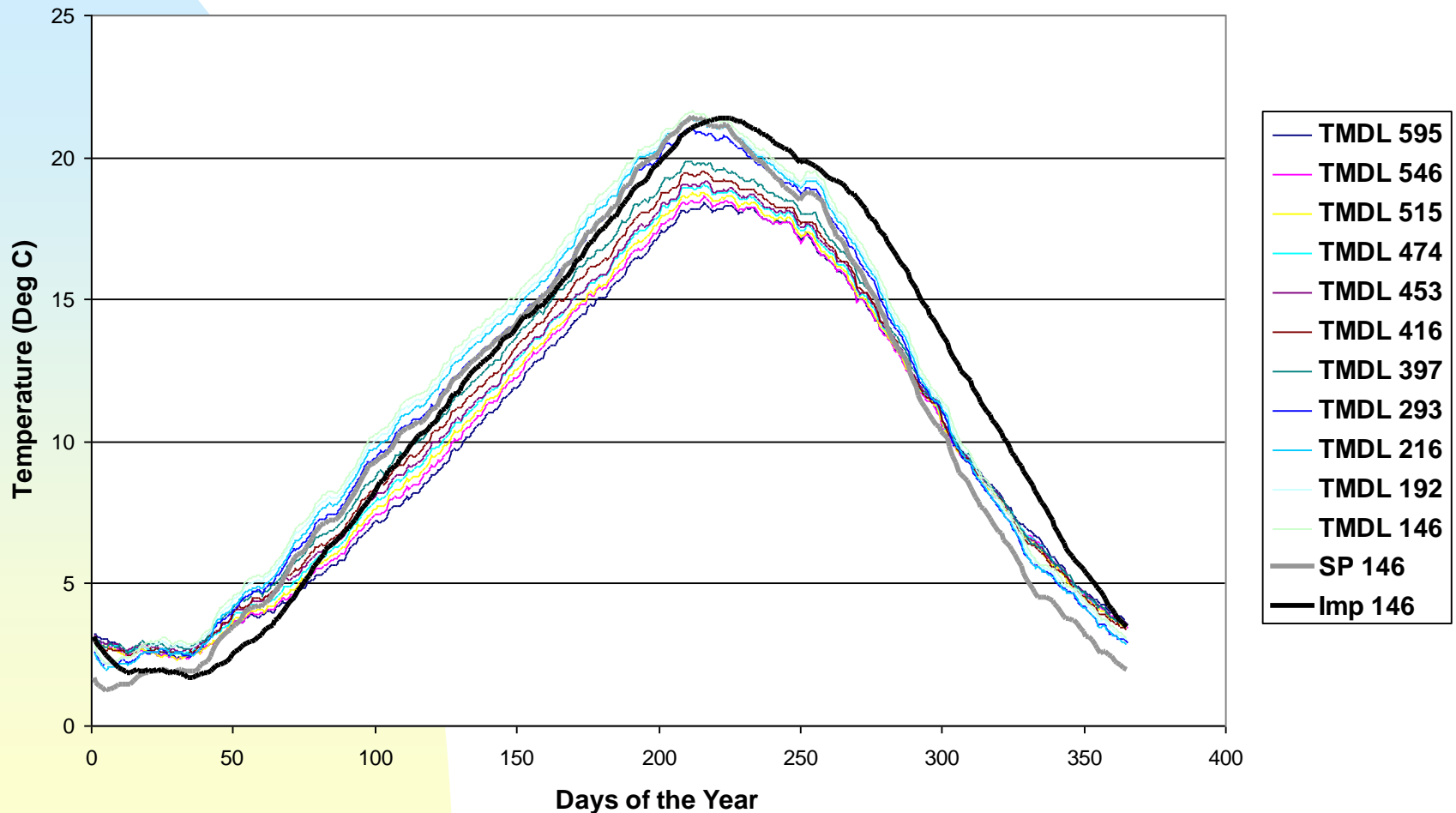
- Site Potential Temperatures instead of Natural Temperatures
- Daily Average Temperature instead of Maximum
- Target Temperatures = Average Site Potential + increment from WQS
- The downstream WQS are more restrictive and drive the TMDL target temperatures in the mid-Columbia (OR WQS).
- The TMDL establishes loads for Target Sites.
- The Load is expressed as Temperature
- The Loading Capacity = the Target Temperature
- Temperature available for allocation is the WQS increment.

# Important Points

- There are many ways to allocate Target temperature among the Target Sites.
- The point sources raise river water temperature very little; never more than 0.14 C (the OR WQS).
- Most allocation schemes that attempt to give the dams incremental temperature increases would require the point sources to decrease load.
- Short Term dam specific compliance monitoring might not be possible.

## Approach 1

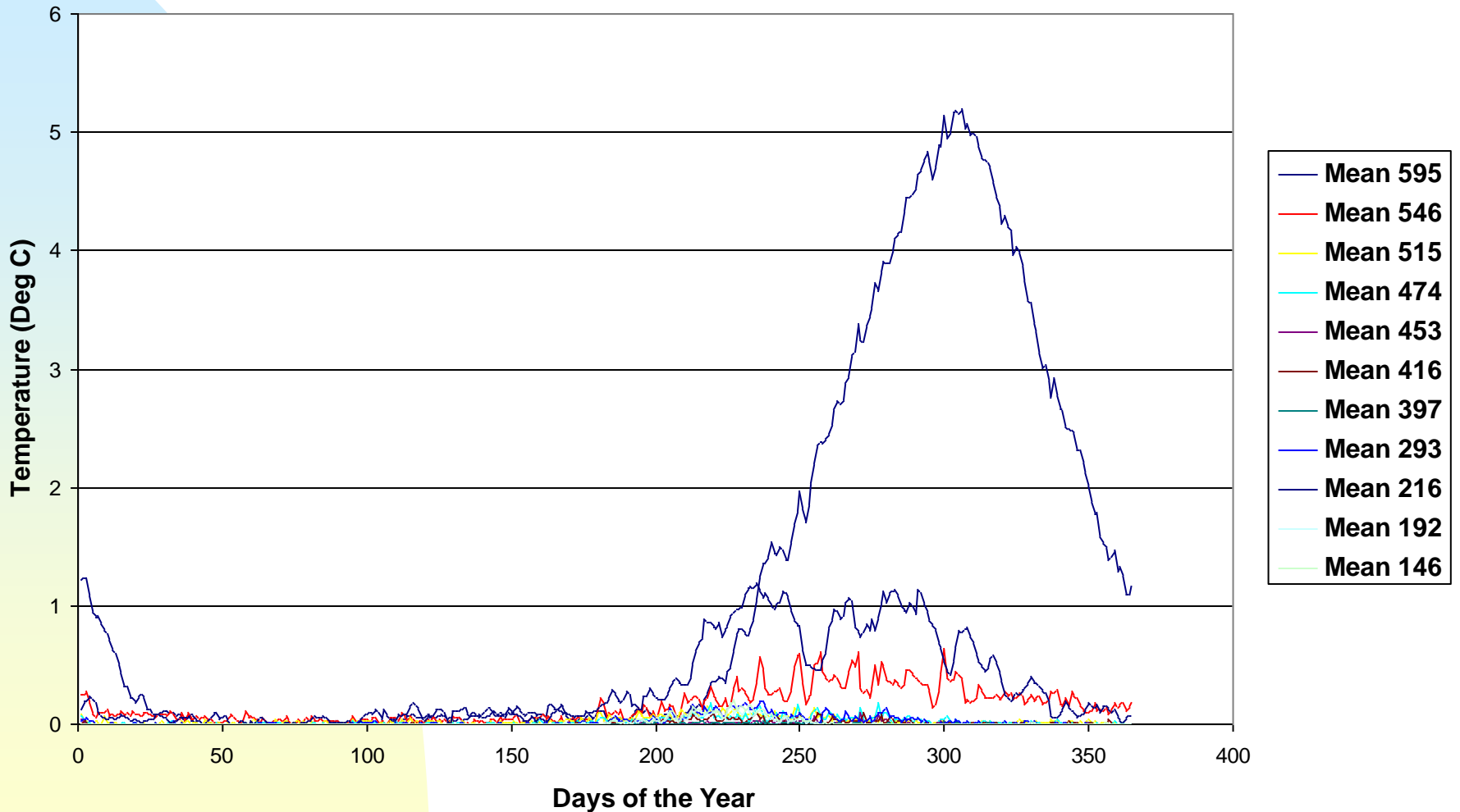
### Columbia River TMDL Temperatures at Each Target Site with Bonneville Site Potential and Impounded Temperatures





# Approach 1

## Temperature Improvements Needed at Each Columbia River Target Site



# Approach 1

## Temperature Improvements Needed at Each Snake River Target Site

